Introduction

DHSS rules mandate that a site/soil evaluation be performed for each proposed onsite wastewater treatment system (OWTS) that is to be permitted. These evaluations, which must be done by registered individuals (see Section 5.9), are used to determine what onsite systems are appropriate for the location. These evaluations may also point out any particular design features that may be necessary for a system to perform correctly. There are currently two types of soils evaluations allowed: soil morphology evaluations and percolation tests. A proper understanding of these evaluations and the ability to interpret site/soil evaluations are essential parts of an onsite sewage program.

Duties of Onsite Sewage Program Staff and Office Support

1. Provide consultation and technical assistance to regional staff and LPHA personnel;
2. Coordinate or conduct training for regional staff and LPHA personnel;
3. Fulfill common responsibilities of LPHA in counties where OWTS are permitted by DHSS.

Duties of other DHSS Staff

1. Provide technical assistance to LPHA personnel and installers of OWTS;
2. Conduct training courses for LPHA personnel and OWTS installers;
3. Fulfill common responsibilities of LPHA in counties where OWTS are permitted by DHSS.

Common Responsibilities of Local Public Health Agency

1. Provide technical assistance to installers of OWTS;
2. Interpret and recognize the morphologic features described in the soil morphology reports and determine what type of onsite system(s) would be best suited for the site;
3. Interpret percolation test results and determine what type of onsite system(s) would be best suited for the site.

Soil Morphology Evaluation Reports

Only registered persons may perform soil morphology evaluations for the purpose of design and construction of an OWTS. You can find lists of Registered Onsite Soil Evaluators at http://www.dhss.mo.gov/Onsite/ose_map.html or contact the Onsite Sewage Program to check the status of an individual. The evaluator must be registered or the report cannot be accepted. The onsite soil evaluator must evaluate nine items detailed in 19 CSR 20-3.060 (2)(A) 2 through 10 and six factors detailed in 19 CSR 20-3.060 (7)(C). Each of the six factors from subsection (7)(C) must be classified as suitable, provisionally suitable, or unsuitable for a conventional system and a site diagram must be included. In addition, a conventional loading rate must be reported for any horizon that is not classified as unsuitable. Sample site/soil evaluation forms are available at http://www.dhss.mo.gov/Onsite/SiteEval.pdf. These forms can be used to report required information as well as other commonly reported soils information. If any required information, needed to determine whether a proposed system complies with the minimum construction standards, is not submitted, the soil morphology evaluation report should **not be accepted** until a complete report is provided.

Soil properties vary from place to place. Soil morphology evaluation reports describe the physical properties present in a soil profile. Because the report contains important information about the site and soil suitability for OWTS, it is important to have an understanding of the terminology used. When reviewing an application that is based on a soil morphology evaluation report, the environmental public health specialist must be able to read and interpret the report to determine if the system design, as proposed by the installer or engineer, complies with the rule.

Some important information that a soil morphology evaluation report must include are as follows: site characteristics, site map, profile description, suitability classification of soil drainage and restrictive horizons, etc., soil group, and assigned soil loading rates. Specifics about site characteristics and the site map can be found in 19 CSR 20-3.060 (2), and 19 CSR 20-3.060 (7) discusses in detail the soil evaluation, suitability, drainage and restrictive horizons. Where available, the NRCS Soil Survey report for a county is also a source of information that will help interpret soil morphology evaluation reports. Many onsite soil evaluators provide a “comment” section that clarifies or interprets the report. In addition to using the previously mentioned references, following are some limiting factors to keep in mind.

Depressions or other concave landscapes can cause surface runoff to converge. This convergence results in poorly drained soil conditions. When soils are poorly drained any wastewater introduced will not be readily absorbed and treated by the soil and may result in ponding conditions.

Large sloping areas above an onsite system can result in significant runoff. If a system is to be installed in such an area, runoff will need to be diverted with berms or intercepted in some manner, such as with curtain drains. Trenches installed on slopes must follow the contour.

OWTS should not be installed in areas subject to frequent flooding (defined in the USDA Soil Survey Manual as 50 or more times in 100 years). Flooding of the sewage tank or treatment field can result in contamination of surface waters. If a system is to be installed in an otherwise suitable area where even occasional or rare flooding is possible, system design measures may be required to prevent infiltration into the tank, prevent tank floatation, protect the absorption field from erosion, and if necessary address sewage treatment and disposal (off site if necessary) during periods of flooding.

A geologic sub-feature, known as karst geology, is common in Missouri and is a limiting factor for system installation. In areas of karst geology, water movement through underlying rock layers has dissolved some of the rock creating a system of caves, sink holes, and springs. Where sinkholes, caves, fissures or cracks in the limestone bedrock occur, a poorly designed sewage treatment system could easily contaminate groundwater.

Important Profile Description Features

The features discussed below are important characteristics that appear in a soil morphology report and are necessary to determine the soil group and loading rate, as well as to understand how water moves within the soil profile. The paragraphs below briefly describe these features, and further information about the profile description can be found in 19 CSR 20-3.060 (7). **Texture** is the designation given to the soil material based on the percentages of three sizes of soil particles: sand, silt and clay. Loam is a combination of the three particle sizes, where each has equal influence. Wastewater movement and treatment are directly affected by the soil texture. Wastewater moves quickly through sandy soils with little treatment. Clayey soils have the greatest surface area to effectively treat wastewater, however since water moves slowly through clayey soils, conventional gravity distribution of the wastewater may overload the site and effluent may surface. The loam textural classification has the right amount of the three particle sizes to treat wastewater most effectively. The textural estimate is also used to further classify the soil into soil groups. After they have estimated the soil texture and the soil structure, the onsite soil morphology evaluator uses Tables 13 and 14, in the DHSS rules governing OWTS, to determine the soil group and the application or loading rate. The soil groups have some general qualities that are worthwhile to know, but it is important not to "stereotype" soils based on the soil group. For example, there maybe a restrictive horizon or indication of a high water table that would affect the system selection and design.

The shape that the aggregation of sand, silt and clay particles forms is known as **structure**. As these particles stick together they form specific shapes, and between these shapes there are voids or pores. This pore space is described as **porosity** and is where oxygen and water move. Three properties are used to describe structure: grade, class and type. Grade describes how easily the pieces of soil break out into the structural elements. Commonly used terms for grade include: structureless or massive, weak, moderate and strong. Class describes the size: very fine, fine, medium, coarse, and very coarse. Type is the most important structural property described. Prismatic, columnar, granular, platy and blocky are structural types. The type determines the size and the amount of pore space, and ultimately how water moves. While color is an indicator of how the soil has handled water in the past and how water may affect the soil currently, well-defined structure is what allows water to move.

Structure, however, is not the only characteristic affecting water movement. Porosity also affects the amount of water a soil will hold and how rapidly the water moves through the soil. It is important to remember that porosity and soil structure are easily destroyed. This happens through careless use of equipment or excavation when soil moisture content is too high. Additionally, as the clay content increases, the ability to alter the soil structure and thus affect porosity increases. This is one of the reasons that a backhoe bucket can do so much damage to the trench sidewalls in a clayey soil.

The Munsell system is a standard system used to describe **soil color**. An onsite soil morphology evaluator uses Munsell notation to describe the dominant matrix color, as well as mottle colors. **10 YR 5/2** is an example of a Munsell color notation, where the 2 in the notation represents the chroma. It is important to remember that dull grayish colors, indicated by a low (1 or 2) chroma Munsell notation, may be a sign that saturated conditions are present or were present in the soil. When soil is saturated, the absence of oxygen limits wastewater treatment. Bright, high chroma colors are preferred. Dark colors often mask dull low chroma colors. Dark colors can also indicate more organic matter, which aids in the treatment of wastewater.

Soil drainage problems can be a result of internal causes including the amount of clay, the structure and porosity, and restrictive horizons, or external causes including topographic position, such as floodplain, depression or foot slope. A high water table may adversely affect effluent treatment and dispersal.

Vertical separation, the distance between an absorption trench bottom or the drip emitters, and a seasonal high water table or other limiting layer, is important to the proper functioning of an onsite soil treatment system. Provided sufficient vertical separation is maintained, consisting of suitable unsaturated soils, effluent will be adequately treated before it is recycled to ground or surface waters. See the discussion of vertical separation, on page 7, under Conventional Absorption Systems of this section.

Restrictive horizons can be recognized by their apparent resistance to excavation. Common restrictive horizons are fragipans and claypans. A fragipan is a genetic soil horizon that perches water and limits root penetration. It is brittle and has a high bulk density. A claypan is a horizon that has a minimum of twenty-five (25) percent more clay than the horizon above. It often has a high shrink-swell potential and tends to perch water at its boundary and throughout. The depth and thickness of a restrictive horizon affect a soil's suitability. Those specifics can be found in 19 CSR 20-3.060 (7)(I)

Site Suitability
The following features must be classified as suitable, provisionally suitable, or unsuitable: topography and landscape position, texture, structure, drainage, thickness, restrictive horizon and available space. If all criteria are classified the same, that classification prevails. Where there is variation in the classifications, the lowest uncorrectable characteristic will determine the overall site classification. Conditions described in 19 CSR 20-3.060 (7)(K) can be used to reclassify a site to a more useable level. Overall site classifications are further described below.

Suitable: There are only slight limitations. A well designed and installed septic tank and conventional soil absorption system would be expected function properly.

Provisionally Suitable: There are moderate limitations. Careful planning, design, and installation are necessary for a soil treatment system to function. Some site or system design modifications, or an alternative system may be required to overcome limitations.

Unsuitable: There are considerable limitations. The site may only be used for an onsite treatment and soil absorption system if it can be reclassified as provisionally suitable. If an engineered design, soil studies and/or hydrogeologic studies, provide adequate substantiating data and reasonable assurance of the performance of a system, the site may be reclassified as provisionally suitable on that basis.

Soil Loading Rates
Tables 13 and 14, in the DHSS rules governing OWTS are used to determine the application rate or loading rate for the soil. The soil evaluator must report this rate. Use the tables to confirm the reported rate is within the range, based on the reported soil texture and structure. A more conservative rate, based on the evaluator's observations would be acceptable. However, a more liberal rate must have adequate justification.

Interpretation of Percolation Tests
A percolation test is the other method of site/soil evaluation that is allowed by DHSS rules governing OWTS. Compared to a soils morphology evaluation, which can provide good information for system design on any type of soil, a percolation test has some inherent limitations. A critical limitation of a percolation test is its inability to detect a seasonal high water table. This can result in an indication that a soil is better suited to a soil treatment system than it actually is. Therefore, when a percolation test is submitted as the site/soil evaluation for a proposed OWTS, it is strongly suggested that the reviewing EPHS look up the site in the county NRCS soil survey report, if available. If the sanitary facilities or engineering interpretations tables indicate that the site would have severe limitations for an onsite soil absorption system, a soil morphology evaluation should be requested. Or if other soil morphology reports in nearby areas indicated shallow depths to seasonal high water or restrictive horizons, a soil morphology evaluation should be requested.

Proper procedure is the most important factor in obtaining accurate percolation test results. It is important to begin the review by making sure that a certified percolation tester performed the perc test. Contact the Onsite Sewage Program for a current list of Registered Percolation Testers. The tester's name must appear on the list from the state or the perc test cannot be accepted. Since proper procedure is important, each EPHS reviewing a perc test must know the proper procedure and see that each perc test performed follows this procedure. This procedure is detailed in 19 CSR 20-3.060 (2)(D). In addition to the perc test, DHSS rules governing onsite sewage require evaluation of nine site conditions detailed in19 CSR 20-3.060 (2)(A), paragraphs 2 through 10. If any information related to those nine items is not submitted, or if after reviewing the perc test any of the statements in the checklist below are false, the perc test should **not be accepted** until a complete report is provided. Check the process and, if working in an area with sandy soils, check the rule, because a somewhat different procedure is used. Verify:
1. The twenty-four (24) pre-soak procedure was followed;
2. At least four (4) holes were tested;
3. The diameter of the holes was six to eight (6 to 8) inches;
4. The depth of the holes was between eighteen and thirty (18 and 30) inches and the proposed absorption trenches are at the same depth;
5. It appears that the perc test was conducted so that the water level was measured from a fixed reference point, and that the hole was refilled between measurements; the measurements were recorded to the nearest one-eighth (1/8) inch; and readings were taken at thirty (30) minute intervals;
6. The test continued until a stabilized rate was reached; that is, the test continued until three (3) consecutive percolation rate measurements varied by a range of no more than ten percent.

It is important to check the math on a perc test report. To obtain the perc rate divide the time interval in minutes by the drop in water level in inches. This yields the perc rate in minutes per inch. To check that the perc rate for each hole stabilized, divide one perc rate by another. The result for any two of the last three test rates must be between 0.90 and 1.10 to vary by no more than 10%. If your review of the math finds errors, inform the perc tester and require a corrected test report.

By rule, the slowest perc rate is used to size the system. Where the slowest perc rate varies by more than twenty (20) minutes per inch from the other rates, and an average of the perc rates is proposed as the basis for a system design, a detailed soil morphology evaluation must be conducted. If a soil morphology evaluation is conducted, the EPHS should require the size of the system to be based upon the soils evaluation that produces the most conservative system design. Once verified the perc rate can then be used to calculate the size of the absorption area, by using Table 5 or Table 7 in the DHSS rules governing OWTS. These tables in 19 CSR 20-3.060 (5)(A) and (6)(C) also contain footnotes that require additional information or special design criteria for certain conditions.

System Selection

Probably the most difficult aspect in interpreting the soil morphology report or percolation test is to determine which system(s) is (are) proper for a site. The DHSS rules separate onsite wastewater treatment and dispersal systems into two categories: conventional (gravity) soil treatment systems and alternative systems. Unfortunately, clear guidance is lacking when determining which system to install given specific site or soil conditions. So how should one choose the best system for a site? The installer and the environmental public health specialist need to know what the perc rate implies or the soil group, soil suitability, and soil loading rate mean, as well as understanding OWTS specifications and functions.

Conventional Absorption Systems

The conventional soil absorption system consists of a system of trenches separate from each other and each containing a distribution pipe. Distribution is generally by gravity. Historically, this type of system consisted of trenches with rock and pipe backfilled with native soils. Now various gravelless systems are also common. Gravelless systems are considered conventional and can generally be used only where a gravel and pipe system could be used. A conventional system should be used wherever practical. Conventional soil absorption systems are described in detail in 19 CSR 20-3.060 (5).

When a perc test is used, footnotes to Table 5 of the DHSS rules detail limitations based on perc rates. The table also specifies the minimum conventional soil treatment system sizing for trench bottom areas.

When a soil morphology evaluation is used, the soil evaluator indicates potential limitations by classifying site factors as provisionally suitable or unsuitable. A suitable overall site classification generally indicates a conventional absorption system can be installed. The soil evaluator should report a conventional system soil loading rate, based on Table 13, which is used to calculate the minimum required conventional absorption system trench bottom area. Usually the lowest reported loading rate between the soil surface and one foot below the trench bottom is used, because hydraulically overloading the soil has the potential for creating saturated conditions or overloading the soil's treatment capacity. Trench bottom area in square feet is calculated as the design daily flow in gallons divided by the soil loading rate in gallons per day per square foot.

Based on either soil test method, the minimum trench length is determined by dividing the required trench bottom area by the proposed trench width. The length of gravelless systems is determined by dividing the required trench bottom area by the equivalent widths detailed in 19 CSR 20-3.060 (5)(A) 15.A or E. The equivalent width for polystyrene bundles is not included in the rule. For calculation purposes, one 12-inch bundled expanded polystyrene (EPS) absorption field product can be considered equivalent to a 24-inch wide gravel and pipe system. In the case of chamber systems, an additional reduction of not more than 25 percent may be allowed, provided a soil morphology evaluation indicates good soil with no limiting conditions and the loading rate of the equivalent trench area does not exceed the maximum rates given in Table 6 for the soil group. Many Missouri soils would not support this reduction and it is not available for systems based on a perc test. Generally 36-inch wide trenches should not be used in soils with a perc rate slower than 45 minutes per inch, or a loading rate of less than 0.45 gallons per day per square foot.

Soils with a perc rate of thirty-one to forty-five (31 to 45) minutes per inch, or group III soils are considered ideal for treatment. However, there could be obvious soil, site or topographic limitations, such as restrictive horizons, poor drainage, steep slopes or unfavorable landscape position that would require modifications.

Some factors classified as provisionally suitable pose only slight limitations for conventional systems. For example, provisionally suitable texture or structure may only require that the system be installed when the soil is dry enough to crumble and if necessary the trench sides and bottom must be raked or picked to remove smearing. As discussed below, some limitations may be more difficult to overcome.

Because the soil absorption system is intended to treat and disperse wastewater, it is important to make site or system modifications when necessary to overcome limitations. Both perc test reports and soil morphology evaluations should report slope limitations. In general, on slopes steeper than 15 percent, soils must be deeper than otherwise required. Trenches wider than two feet can be difficult to install and maintain the necessary vertical separation and minimum cover. On slopes steeper than 30 percent, terracing and other requirements must be met. These requirements and others relating to slope are detailed in 19 CSR 20-3.060 (5)(A)11.

Other potential site limitations for conventional systems relate to **vertical separation**. Vertical separation is defined as the distance between the absorption trench bottom and a limiting condition, such as a seasonal high water table, bedrock or a restrictive horizon. Vertical separation requirements are in place to ensure a zone of at least provisionally suitable, unsaturated soil to adequately renovate the applied wastewater before it is recycled into groundwater or surface waters. Both perc tests and soil morphology evaluations should report the depth to the limiting conditions mentioned above, if they are present. The following table shows minimum vertical separation distances required.

TYPE of SYSTEM	SITE/SOIL LIMITATION or CHARACTERISTIC	VERTICAL SEPARATION (FEET)
CONVENTIONAL		2
	Rapid percolation	4
	Cherty clays in areas of concern for groundwater	4
Serial		3
Dosed D-box		2
Shallow placement		2
LPP		1
	Areas of concern for groundwater	4
DRIP		1
SAND MOUND		2
	Groundwater contamination potential	4
LAGOON	Creviced bedrock	3
	Or a minimum clay liner thickness of:	1

The minimum vertical separation required for a conventional system is 2 feet. Although there are several site conditions where the rule specifically requires two, three or four feet of vertical separation, two portions of the rule have been interpreted to permit one foot of separation as the standard. First, subsection 5(A) Absorption Systems paragraph 2 of the minimum standards states, in part, "The vertical separation between the bottom of the absorption trench and limiting layer or seasonal high water table shall be no less than one foot (1')." Second, subsection 7(G) Soil Drainage of the rule states that, "soils with a seasonal high water table less than forty-eight inches (48″) and more than twenty-four inches (24″) below the naturally occurring surface shall be considered provisionally suitable for soil drainage, provided there remains at least twelve inches (12″) of soil between the proposed trench bottom and the seasonally high water table."

In the first paragraph referenced above, the rule also states, "The absorption trench shall be located on the property to maximize the vertical separation…," and "Greater vertical separation may be required where water-bearing formations are in danger of contamination." Therefore, one-foot (1') should be considered the absolute minimum for conventional systems, not the standard. Locations where there is concern about groundwater contamination should be investigated by a registered geologist to determine if the site has severe geological limitations. You may contact the Onsite Sewage Program for assistance, or contact the Department of Natural Resources (DNR), Division of Geology and Land Survey (DGLS).

The second citation only refers to seasonal high water, not bedrock or restrictive horizons. If a typical twenty-four inch trench depth were assumed, requiring forty-eight inches between the soil surface and a seasonal high water table for classification as suitable would provide two-feet of vertical separation. Thus, site conditions where the vertical separation would be between two-feet, which is suitable, and the one-foot minimum would result in a provisionally suitable classification. When a factor is provisionally suitable, site or system design modifications or a variance must overcome the limitations. These are discussed below.

The most common site modification used to lower a seasonal high water table and increase vertical separation is a curtain drain. Where it is well established by a soil evaluator that seasonal high water results from lateral movement of water through the soil profile or from surface run-on to the area, a properly designed curtain drain is appropriate. This is most often on a side slope a significant distance from the top or break of the slope. Occasionally we review plans proposing a curtain drain on level sites or near the top of a slope. In these cases the seasonal high water table may be caused by poor surface drainage or ponding of water on a restrictive horizon, and not by lateral movement of water. A curtain drain would not adequately lower the water table in these cases.

The depth of a curtain drain is also an issue. It cannot be assumed that the water table will be lowered to the bottom of the curtain drain trench and maintained at that depth under the absorption field. Especially as the number of trenches placed on a slope increases, water mounding under the distribution system can reduce the vertical separation gains expected from installation of a curtain drain. When there is a restrictive horizon or other slowly permeable horizon, the curtain drain bottom should be keyed into it at least 4 to 6 inches. If no such horizon is present, an experienced soil evaluator, designer or EHPS may be consulted.

If site modifications cannot maintain the minimum required vertical separation, it may be possible to overcome limitations with system modifications, such as shallow placement, sand lined trenches or through use of an alternative system design, such as discussed below. Shallow placement modifications and sand lined trenches are detailed in 19 CSR 20-3.060 (5)(B). If the minimum vertical separation requirements cannot be met it may be possible to reduce the vertical separation through the variance process (see section 5.4 of these guidelines). However, higher pretreatment, dosing or other requirements may apply and at a minimum, one foot of vertical separation must be maintained between the conventional system and a seasonal high water table.

Alternative Absorption Systems

When a conventional system cannot be installed or is not the most suitable method of treatment because of limiting soil conditions, an alternative system should be considered. Some may believe that the term “alternative” implies untested or experimental types of systems, but that is not the case. Requirements for alternative systems are detailed in 19 CSR 20-3.060 (6).

Requirements for **lagoons** are detailed in 19 CSR 20-3.060 (6)(D). Lagoons are best suited to soils with slow perc rates, such as greater than one hundred and twenty (120) minutes per inch or in group IVb soils. Provided the lagoon is properly constructed and not allowed to dry out, the expansive clay soils will not crack and cause the lagoon to leak. Lagoons maybe installed in soils with perc rates between sixty-one to one hundred and twenty (61 to 120) minutes per inch or in group IVa soils provided the clay material is well worked and sealed or an artificial liner or bentonite is used. Highly permeable or gravelly soils are generally not suited for lagoon construction. Severe geologic limitations and setback requirements must be considered for sites where a lagoon is proposed. (The setback requirements to residences specified in subsection (6)(D) take precedence over setbacks to a building foundation or basement in Table 1.)

The minimum surface area of a lagoon is based on the number of bedrooms. The DHSS rules governing OWTS allow discharge from a lagoon provided the effluent does not leave the property where it is generated. Lagoons are generally not suitable in subdivisions with lots smaller than three (3) acres.

Low-pressure pipe (LPP) systems are described in 19 CSR 20-3.060 (6)(C). Site limitations, such as steep slopes, slowly permeable soil conditions, shallow soils, or inadequate vertical separation, may be overcome by an LPP system. A LPP system can be designed to accomplish uniform distribution on sites with steep slopes, although construction difficulties may be limiting. The LPP system uses dosing and resting cycles to maintain aerobic conditions, and shallow placement of laterals uses the more permeable upper horizons.

When a perc test is used, Table 7 of the DHSS rules specifies the minimum sizing, per bedroom, for the total absorption system area. When a soil morphology evaluation is used, LPP or alternative system loading rates are to be reported by the evaluator based on Table 14. If the soil evaluator only reports a conventional system soil loading rate, Tables 13 and 14 may be used to determine the corresponding LPP system loading rate based on the soil texture and structure. As with conventional loading rates, usually the lowest loading rate between the soil surface and one (1) foot below the trench bottom is used. The minimum LPP system area in square feet is calculated as the design daily flow in gallons divided by the LPP soil loading rate in gallons per day per square foot. The minimum LPP trench length is determined by dividing the required distribution area by the minimum trench spacing of five (5) feet.

There are some minimum site requirements to remember when considering a LPP system. Two (2) feet of suitable soil is needed above the limiting condition and a minimum of one foot of vertical separation is required. Where highly permeable, cherty clay soils or severe geologic limitations are present, four (4) feet of vertical separation is required.

A **drip irrigation** soil dispersal system design can overcome limitations similar to or more severe than an LPP system. In addition, drip irrigation systems may be installed on sites with high shrink swell, IVb clay soils. One difference between the two systems is the drip lines are typically placed shallower, at six (6) to ten (10) inches deep.

Requirements for drip irrigation systems are detailed in 19 CSR 20-3.060 (6)(H). The absorption area for a drip system is based on the same loading rate as an LPP system, except that a maximum rate of 0.05 to 0.1 gallons per day per square foot is allowed for IVb soils. A minimum vertical separation distance of one foot is required to a seasonal high water table or other limiting condition.

The **sand mound** is a distribution field that is raised above the natural soil surface. Final dispersal occurs as the effluent moves through the gravel and sand into the natural soil below. Requirements are detailed in 19 CSR 20-3.060 (6)(E). There must be at least two (2) feet of vertical separation between the bottom of the mound and the limiting condition. Four (4) feet of soil over bedrock may be required in areas where there is a significant groundwater contamination potential. In addition, downslope setback requirements are increased for mound systems. Sites with high water table limitations in permeable soils would be better suited for mounds than sites with underlying slowly permeable horizons.

Alternative Treatment Systems

Alternative treatment systems include constructed wetlands as detailed in 19 CSR 20-3.060 (6)(I), and sand filters as detailed in 19 CSR 20-3.060 (6)(G). In addition system designs using bio-filter media such as peat, foam and textile can treat wastewater to a higher effluent quality. These and other system designs must comply with the requirements of 19 CSR 20-3.060 (6)(K).

Most onsite soil absorption systems are sized based on septic tank quality effluent. Since highly treated effluent does not promote the development of a biomat as septic tank effluent does, soils may have a higher long-term acceptance rate when preceded by an alternative treatment system. In addition, if a system, which provides higher treatment, is installed and maintained the soil is not required to provide as much treatment. When high pretreatment is proposed, higher proposed loading rates – still within the ranges given by Tables 13 and 14 for a soil's texture and structure – may be accepted. Also, reduced absorption field areas may be allowed following alternative treatment systems. Except for a one third (1/3) reduction for absorption field areas following sand filters, which is allowed by the rule, variances would be required for a reduction for other higher pretreatment systems.

AUTHORITY
Chapter 701.025 – 701.059 RSMo
19 CSR 20-3.060